



Spread of *Phytophthora ramorum* onto the foliage and stems of conifer species in Britain

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Glynn Valley, south west England







- Dieback of Japanese larch in south west England reported to Forest Research, Alice Holt. Triggered a visit in August 2009
- Visits to Forestry Commission estate at Plym, Canonteign and Largin to look at the problem on larch and sweet chestnut.
- Samples taken from sweet chestnut (Canonteign) and beech (Plym) with bleeding cankers
- Only at Largin was any Pr diseased rhododendron noticed, but shoot wilting also noticed on young larch, plus beech with bleeding canker
- End result: larch foliage, beech and sweet chestnut bark all found to be Pr positive
- Infected rhododendron **absent** on most of these sites



Foliar symptoms on larch





Foliar symptoms on larch





Plym

Widespread dieback on Japanese larch (Larix kaempferi)







P. ramorum isolated from resinous lesions



Impact on other species

- Accumulating evidence that where ever infected larch was found, other nearby or understorey species were also becoming infected with Pr
 - These included the usual suspects: beech (bole host), sweet chestnut (bole and foliar host), rhododendron (foliar)
- New hosts
 - Birch (Betula pendula), bole host
 - Douglas fir, bole host
 - Western hemlock, bole host and foliar host
 - Port Orford Cedar, bole host
 - Grand fir, foliar host









Symptoms on birch & beech







Symptoms on rhododendron





Symptoms on hemlock





Symptoms on Doug fir

Approx 4 year old trees, infected larch in backround

Cankered here: dead branch

Cankered here: dead top









Symptoms on 5-7 yr Doug fir

Most recently have found Pr associated with dieback in top 2m of a mature Doug fir





Our observations/findings so far

- Larch dieback and mortality widespread in some forests in the west country
 - Symptoms on affected larch needle loss, dieback of fine branches leading to cankers on main branches and trunk
 - Mature trees (25-40 years) have multiple cankers, eg 35cm dbh tree, with more than 80 individual resinous cankers
 - P. ramorum isolation hit rates for both larch bark and foliage are relatively low (10-40% for lesions in bark; 30-50% for foliar samples). However, may reflect time of year
 - Larch appears to be a sporulating host and 'endangering' other species



Is larch a sporulating host?

- Larch is a deciduous host, so time frame for sporulation tests was short in 2009
 - Shoot tips of larch 12cm long, harvested in October
 - Dipped in zoospore suspensions of *P. ramorum*
 - Wounded
 - Non-wounded treatments
 - Each shoot maintained in water, and incubated under high humidity
 - Comparisons with rhododendron leaves
 - Assessed after 7 and 10 days



Outcome of foliar susceptibility tests

- Wounding of larch needles not required for infection
- Various categories of symptomatic needles
 - blackened and browned needles usually infected, as demonstrated by back-isolation
 - chlorotic, banded, green rarely infected
 - occasional evidence of asymptomatic infection
- Sporangia and chlamydospores visible on/in infected needles
 - sporangia numbers range from 10s to 1000s per needle
- Need to look again using start of season in 2010 rather than end of season shoots



Sporulation on larch foliage









Next steps.....

 Wide scale felling in the west country to remove infected larch before bud burst to counter the next 'burst' of foliar sporulation

Potential for transmission off site

- via timber
- people/machinery
- 10,000 trees felled, what do we do with the timber?
- Biosecurity measures loom large
 - Public asked to stay away especially when felling
 - Disinfection boots; machinery
 - Brash left behind
 - Burn high risk of fire
 - Mills must meet certain criteria timber, bark, sawdust
 - Biofuel; chip as residue composite board; fencing preservative
- Overwintering on affected trees in buds? So far little/no evidence of this
- Long term contamination of sites
- Time of sporulation throughout the growing season or end of growing season?



Numbers of Affected Larix kaempferi felled

Site	Gross Area	Net Area	Approx Tree	Approx Vol
	На	На	Number	M ³
Site 1, Largin	13.0	11.1	2652	3094
Site 2, Plym	10.3	9.3	2039	2688
Site 3, Canonteign	0.7	0.6	145	164
Total FC	24.0	21.0	4836	5946
Site 4 (private)	2.2	1.9	748	187
Site 5 (private)	3.6	3.1	734	857
Site 6 (private)	17.0	14.5	3902	3468
Total PW	22.8	19.4	5384	4512
Total Combined	46.8	40.3	10220	10458



































Forestry Commission April onwards - dieback in larch



Forestry Commission April onwards - dieback in larch





April - needle death in larch





Bud flush failure in larch





Next steps.....

- More surveys on the ground have revealed further infection
- Aerial surveys with helicopters now underway









































Flight path of aerial surveys





Potential new findings





Further steps.....

- More surveys on the ground have revealed further infection foci
- Aerial surveys now being extended to southern Wales
- Pr just recently found infecting larch in Wales
- +ve bark samples





Flights extended into Wales







We have much to learn about this pathogen!

- Thanks to
 - Barnaby Wylder and Mick Biddle, FC team
 - Tony Reeves and Alan Ockeneden, TSU Exeter, FR
 - Suzy Sansici-Frey, Pathology, FR
- Keith Walters and the Fera team
- Funding provided by
 - Defra/Fera Phytophthora Programme
 - Forestry Commission